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ABSTRACT

The successful implementation of Alberta's learner outcomes in information and communication technology will depend on the ability of educators across the province to understand how change occurs and what change means for those who are involved. Schools and school jurisdictions also must have a clear vision for the future and provide effective leadership and ongoing support for staff development. This report presents a review of the literature, focusing in the following areas related to the successful implementation of new curriculum and classroom projects: (1) understanding change theory; (2) vision, including technology as a higher-order thinking skill; (3) leadership; (4) technology integration plans, including overview, scope and sequence, instructional models and organizational issues, curriculum integration, and resources (i.e., software, hardware, and human resources); (5) planning for staff development, including assessing professional development needs and meeting individual needs; and (6) assessing progress. Appendices include: Alberta Education technology planning requirements; a list of 17 related Alberta Education resources; a best practices project template; and examples of the best practices for implementing Alberta's relatively new technology outcomes, as exemplified by 12 schools. (Contains 46 references.) (AEF)

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PREPARING TO IMPLEMENT LEARNER OUTCOMES IN TECHNOLOGY

Best Practices For Alberta School Jurisdictions

February, 1999

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The primary intended audience for this framework is:

Administrators	✓
Counsellors	
General Audience	
Information Technologists	✓
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PREFACE

A major portion of this report is based on a review of the literature. In addition, the authors solicited information about best practices for implementing Alberta Education's learner outcomes in technology. Twelve responses were received (see Appendix D of this report).

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EXECUTIVE SUMMARY

The successful implementation of Alberta's learner outcomes in information and communication technology will depend on the ability of educators across the province to understand how change occurs and what change means for those who are involved. Schools and school jurisdictions also must have a clear vision for the future and provide effective leadership and ongoing support for staff development.

Although resources to support this implementation process have not been extensive to date, help is on the way—in this report and in a variety of other publications, from Alberta Education and elsewhere. This report includes:

- a review of the literature on implementing new curriculum, along with a bibliography,
- descriptions of steps that twelve schools have taken to implement Alberta's relatively new "tech outcomes", and
- a list of relevant Alberta Education publications.

These are some of the key points made in this report:

1. Change takes time, it is not orderly and, because it involves risk-taking, teachers need extensive support and encouragement as they move forward in this area.
2. Everyone involved in the change must share a common vision, and they must be able to refine that vision in response to ongoing feedback. Ideally, the vision will focus on student learning of the technology outcomes, across all subject areas and grades, so that technology is seen as an essential component of the overall curriculum and so that students are well prepared for the information age.
3. The instructional models involved in implementing the learner outcomes in technology may be either direct or "constructivist." The constructivist model, which is less traditional, focusses on problem solving and research skills; for example, exploring open-ended questions. Teachers also may find it useful to use a thematic approach or project-based learning. Generally, technology outcomes will be achieved by integrating them into existing curriculum. Purchasing software and hardware are of course part of instructional planning, but decisions about these matters should be made last (after the program has been planned), instead of first, as is so often the case currently.
4. Staff development may occur by stages; for example, awareness, information gathering, personal growth, time management, concerns about the impact on student learning, collaboration with colleagues and refocussing to do even better. Another researcher describes the stages as survival, mastery, moving towards learner-centred instruction and innovation.
5. As in all aspects of education, assessing progress is a vital part of implementing the learner outcomes in technology.

To achieve the technology outcomes goals we have set for ourselves in Alberta, educational leaders must show their strong support for this initiative and provide for adequate staff development. Teachers and administrators must work together, and be

prepared for false starts and a certain amount of discomfort in exploring unfamiliar territory.

INTRODUCTION

How can jurisdictions and schools and classrooms best prepare to successfully implement Alberta's learner outcomes in information and communication technology? A review of the literature indicates that the following five key elements are required for the successful implementation of new curriculum and new classroom projects.

1. *An understanding of change theory*
   - It takes time for teachers to master computer-based practices and approaches (Sheingold and Hadley, 1990).
   - Change requires ongoing support and assistance; in this case, technical support as well as collegial sharing.
   - Change involves risk-taking and requires an atmosphere that is open and supportive to experimentation.
   - Change is not orderly. The goals and activities take on meaning as people work through the change process and come to understand what the change means for them.
   - Change requires practice and feedback. New skills take time to develop; in this case, teachers require access to technology in order to develop technology-related skills.
2. *A clear vision*
   - Clear vision provides direction and focus.
   - Key stakeholders need to arrive at and support a shared vision.
   - Vision supports ongoing assessment and refinement.
3. *Effective leadership*
   - Leadership is needed at all levels of the organization.
   - Leadership must be responsive to needs and ideas.
   - Leadership must be shared.
4. *A personal understanding of the change and its implications for those who are directly responsible*
   - People need to understand what technology integration is.
   - People need to plan for technology integration, know what resources are required and become familiar with different technology-based instructional models.
5. *Ongoing support through effective staff development*
   - Teachers' concerns need to be addressed before and during various stages of implementation.

- Staff development must respect diversity and build on the learner's current level of knowledge.
- Change theory must be understood and applied.
- Professional developers must recognize the developmental stages of the learners in their use of technology in teaching and learning.
- Beliefs and practices change over time through working with others.

Change is not unidirectional. All of the elements are interwoven and interconnected, and must therefore work in harmony.

"The true power of information technology lies in the fact that it allows us to ask the fundamental question: 'How can we use technology to give students learning challenges which will tap their full potential to solve very complex problems, to manage their own work, and to have global access to information?' Applying technology this way is quite different from using technology to improve our current delivery model." (Alan November, Educational Renaissance Planners, in an interview for *Spectrum* magazine).

A number of documents recently published by Alberta Education (see Appendix B) provide advice and direction about preparing to change classroom practice and student learning as technology becomes a significant part of the education system's vision, policies, goals, results, performance measures and strategies. The central Alberta Education document for the purposes of this study is the *Information and Communication Technology, Kindergarten to Grade 12: An Interim Program of Studies* (June, 1998).

"The future of our children and the future prosperity of Alberta lie in the ability of our students to be successful, productive citizens. To ensure that all of our students have the best advantage possible, Alberta must continually look for new ways to improve student learning. Technology has become an essential tool in continuing to provide Alberta students with a relevant, quality education in the 21st century. Our success in the global economy depends, in part on the effective integration of technology in education...in providing all of its students with the kinds of learning opportunities that will prepare them for success in life and the workplace." (Alberta Education, *Framework for Technology Integration in Education*, p. 1).

Jurisdictions must respond creatively to Alberta Education's directions for change, working within their own realities and constraints to implement integration and achieve the required learner outcomes.

"In business, the acquisition of technology is viewed as an investment, as opposed to a cost. In the same way, schools must learn to see technology as an essential classroom component, as important as pencils, paper, and books." (Heide and Henderson, p. 10).

Administrators and teachers currently have various levels of understanding of and comfort with the use of technology and integrating existing programs of study with the new interim program for technology. As with any other innovation or curriculum change, implementing the new technology outcomes will require changes in behaviour, changes in thinking, and changes in knowledge, skills and attitudes.

UNDERSTANDING CHANGE THEORY

"Implementation is a process of working out the meaning of change with those directly responsible." (Fullan, 1982, p. 116).

Sheingold and Hadley (1990) discovered that it takes five to six years for teachers to master computer-based practices and approaches, provided of course, that they have access to hardware and software both in and out of school so they can practise and experiment. Teachers also need technical support staff on site to offer support in the classroom during the day, give workshops, help with planning and contribute to the development of a school-based technology team. The following examples show how access and support are being provided in Alberta.*

- Dr. Morris Gibson School in Foothills School Division No. 38 has two teachers who work directly with other teachers to develop projects to integrate curriculum and technology.
- Horizon School Division No. 67 has a full-time teacher trainer who travels to schools in this rural area to provide support and workshops.
- Penbrooke Meadows School in Calgary School District No. 19 has a technology co-ordinator who works directly with teachers and students in all curricular areas, providing weekly staff development activities.
- Lacombe Upper Elementary School in Wolf Creek School Division No. 72 has two part-time technology co-ordinators who work with teachers to plan units, conduct research and evaluate/purchase software. The co-ordinators also offer formal and informal professional development activities.
- Central Middle School in Red Deer School District No. 104 has a media and curriculum specialist who helps teachers integrate technology across the curriculum through collaborative planning and mentoring.

Collaboration with fellow staff members relieves the anxiety and uncertainty that comes with change.

"Unless the innovation calls for collaboration among users (such as in team teaching) few users will reach integration." (Hord *et al.* 1987, p. 66).

"Instructional innovation involves not just change in people but also changes in organizational culture" (Sandholtz, Ringstaff and Dwyer, 1997). Cuban's notion of second-order change is that if technology integration is to be effective, it requires introducing "...new goals,

* See Appendix D for more details on these best practices in Alberta school jurisdictions and schools.

structures, and roles that transform familiar ways of doing things..." (p. 342). Likewise, Fullan (1992) emphasizes the need for second- and third-order change in transitions if they are to be truly successful. First-order change emerges from things such as a provincial framework for technology. Second-order change might be viewed as the acquisition of hardware, software and connectivity. The actual re-training of teachers, development of a technology integration focus and climate in schools, and inclusion of support mechanisms, might be viewed as third-order change. At this level, the actual change is effectively supported, adopted and integrated into the daily practice of the school.

Schools must be structured to encourage and support staff members as they interact with peers and reflect on their progress. Also, technology integration involves shared leadership, teamwork and a view of learning as a process of constructing knowledge. The organization (schools, school boards) must therefore model such behaviour. The challenge is for schools to examine how they currently use time and look for creative ways to use it more effectively to meet their needs. With enough time, a certain degree of flexibility and appropriate support, the required change usually begins to occur.

"To be truly helpful to teachers, you must be able to describe how a program will look in actual practice in the classroom" (Hord *et al.* p. 13).

Alberta Education (letter from Deputy Minister to school superintendents, December 2, 1996) has developed these principles for integrating technology into student learning and instruction:

- Technology should be **readily available to students whenever learning occurs** and readily available to teachers to facilitate technology-assisted instruction.
- **Access to technology** should be provided on an equitable basis within each school authority and throughout the province.
- Technology should be used to provide teachers and students with **access to learning resources and information via local and global networks** (such as the Internet).
- Technology should be used to **enhance classroom instruction** and **support individualized instruction**.

"We do not teach the skills or the software separately: each is taught in the context of the project" (Dr. Morris Gibson School, Foothills School Division No. 38).

As these principles indicate, jurisdictions and schools need to examine how they will structure their learning environment to provide opportunities for students to learn about technology as well as how to use technology as a process for learning in all curricular areas. In Penbrooke Meadows School in Calgary School District No. 19, for

example, "Computer literacy is not taught specifically but the technology is introduced in a curricular framework."

One of the most significant events to date regarding the integration of information technology into the teaching and learning environments is the Information and Communication Technology (ICT) Program of Studies. This mandatory kindergarten to grade 12 program (scheduled for implementation in the 2000/2001 school year) defines learner outcomes for technology for all divisions.

Before students can understand the learning agenda and flexibly apply technology, the teacher must know the programs of study and how they can support the achievement of the learner outcomes associated with the *Information and Communication Technology, Kindergarten to Grade 12: An Interim Program of Studies.*

VISION

As shown in Table 1, Gerald Bailey (1997) challenges educators to think about the difference in the teaching and learning environment created by using technology in three distinctly different ways:

Teaching about technology (technology as a ***subject***)	Technology is viewed as a process that enables students to work in more sophisticated ways, to use higher-order thinking skills and to compete successfully in an information age. *Information and Communication Technology, Kindergarten to Grade 12: An Interim Program of Studies* is a program of studies that most students are expected to learn. They are expected to be able to demonstrate the technology outcomes across other curricular areas. In addition, some students may choose to develop advanced technology knowledge and skills; for example, by taking courses in Career and Technology Studies.
Teaching with technology (technology as an ***aid***)	Teachers use technology as a tool to present subject matter in new ways; for example, with PowerPoint presentations or multimedia programs. Technology is used to enhance and monitor student learning.
Technology as an ***empowerment tool***	The focus switches from teacher-directed to student-centred learning, that is, from instruction to construction. Most learning experiences are facilitated through technology; for example, telecollaborative learning, hypertext or hypermedia, simulation software programs and problem-based learning. Technology is used to construct and share knowledge.

Source: Gerald Bailey, "What Technology Leaders Need to Know: The Essential Top 10 Concepts for Technology Integration in the 21st Century," *Learning and Teaching with Technology*, September 1997, pp. 57–62.

TABLE 1: THREE WAYS TO USE TECHNOLOGY

TECHNOLOGY AS A HIGHER-ORDER THINKING SKILL

Alberta Education's ICT program of studies provides a fourth perspective on the use of technology. In addition to developing students' knowledge, skills and attitudes regarding

technology, this program embraces the notion of technology as a process or central elements of a cognitive strategy for addressing a problem.

Educators must have a shared vision of technology. Basic questions will come up about curricular and instructional outcomes, staff support and team collaboration, as well as about staff training and how technology is used in the classroom. Bailey and Lumley (1994) say that empowering students with technology (the third way of thinking about technology) offers a promise for "transformed schools and transformed learning" (p. 129). Technology provides us with techniques and processes that allow us to think differently and do things differently.

LEADERSHIP

If change means "redoing and rethinking," successfully integrating technology into the curriculum requires responsive leadership. Leaders must subscribe to shared leadership that inspires and empowers others. Creating a climate of trust and open communication facilitates the development of teams in which each member shares the vision and has a sense of common purpose. As team members become clear about their decision-making powers, they become more committed and take on more responsibility for leadership.

Sarason (1990) states, "...when a process makes people feel that they have a voice in matters that affect them, they will have greater commitment to the overall enterprise and will take greater responsibility for what happens to the enterprise" (p. 61).

Leaders take an active role in monitoring implementation, listening, identifying and acting on the creative abilities of members of their staff. Leadership involves flexibility and accommodation of differing views and perspectives and changing needs and goals. Effective leaders see problems as challenges and not insurmountable obstacles.

Leithwood (1992) suggests that "transformational school leaders are in more or less continuous pursuit of three fundamental goals:

- helping staff members develop and maintain a collaborative, professional school culture,
- fostering teacher development, and
- helping them solve problems together more effectively" (p. 9–10).

Since, "Change cannot be accomplished from afar" (Fullan and Miles, 1992, p. 752), central office needs to collaborate with and support schools, while allowing them to manage the change locally.

The successful leader, both at the school and jurisdiction levels, ensures support through first-, second- and third-order change. Support includes encouragement as well as celebration of accomplishments and achievements throughout the change.

TECHNOLOGY INTEGRATION PLANS

GETTING AN OVERVIEW

A number of Alberta Education resources and documents provide a foundation for determining the role of technology in teaching and learning in Alberta schools (see Appendix B). Other important resources are the three-year technology plans of the local jurisdiction and the school.

It is important as well to understand from the outset these two commonly used terms: "curriculum within a curriculum" and "technology integration."

Curriculum within a curriculum: Because technology outcomes are interrelated with subject-specific outcomes, they are integrated into a variety of existing programs. Each of the outcomes needs a context to be meaningful. The development of word processing skills, for example, may be addressed within the context of communication.

Technology integration: Technology is taught across the curriculum as part of the subject disciplines. Technology is a process, and the knowledge, skills and attitudes to be learned in technology are related to those learned in other subject areas.

SCOPE AND SEQUENCE

Alberta Education's learner outcomes in technology are **exit outcomes**, that is, outcomes that students will be expected to demonstrate by the end of divisions 1, 2, 3 and 4. Therefore, jurisdictions and schools will likely play a leadership role in identifying a scope and sequence for the learner outcomes, providing clear expectations at all grade levels that lead up to and culminate in successful achievement of the provincially defined outcomes. In this way, jurisdictions and schools are provided with the flexibility they may require because of variations in organizational structures and availability of resources and other unique needs.

To understand what they are responsible for teaching, classroom teachers may need to participate in articulation meetings among jurisdiction or school staff. Jurisdictions and schools may decide to collaborate on what will be taught during the two-year span preceding each exit outcome and the subject area and curriculum topic where each (or several) outcome(s) might best be achieved. Although technology permits a learner to pursue multiple outcomes in multiple disciplines, some technology outcomes are more specifically related to one subject or content area; for example, the use of spreadsheets applies more readily to mathematics than to English language arts. At the same time, teachers should not feel restricted or limited. They should be able to pursue technology outcomes in any subject area where it makes sense to do so. At the web site <http://ednet.gov.ab.ca/techoutcomes/ie>, Alberta Education provides illustrative examples or sample tasks that demonstrate and elaborate on the general and specific outcomes in a variety of subject area contexts and across all grade levels.

Teachers meet one week by grade-level teams, one week by subject areas, one week as an entire staff and one week with the technology teacher or facilitator. There are commonly defined technology projects for each grade and in specific subject areas (Mary Butterworth School, Edmonton School District No. 7).

Clearly, finding time for staff dialogue is critical. Parameters for the dialogue may include the entire staff, divisional groupings, grade-level teams, subject-area teams or other combinations. Through such dialogue, teachers can better understand their roles and responsibilities, share ideas and strategies for integration, develop joint themes and projects and work collaboratively to achieve common values.

INSTRUCTIONAL MODELS AND ORGANIZATIONAL ISSUES

"Most teachers know how to 'tweak' an idea to fit the unique nature of the context (learning styles and preferences, teaching styles and preferences, past experience, resource availability, and other factors).... Reinvention—the process of taking something like a new tool or idea and making it our own in its application—is very important..." (Harris, p. 7).

There is no "one best way" to integrate technology into teaching. Two common instructional models and integration strategies are based on two differing learning theories:

1. A model based on direct instruction arises out of behavioural, information processing and systems theories; e.g., Skinner, Gagne and Ausubel.

2. A constructivist model based on building, creating and sharing meaning arises out of other cognitive or constructivist theories; e.g., Vygotsky, Piaget and Bruner.

As shown in Table 2, these two learning models address very different instructional needs and usually result in different kinds of activities. As the goals of education change to reflect new social and educational needs, strategies for integrating technology into teaching and learning also are changing.

Directed Models	Constructivist Models
Needs addressed by technology: • Providing individual pacing and remediation, especially when teacher time is limited • Making learning paths more efficient for faster learning, especially for skills prerequisite for other, more complex student needs • Performing time-consuming, labour-intensive tasks (e.g., skill practice) to free up teacher time for meeting other, more complex student needs • Supplying self-instructional sequences when teachers are not available or students are already highly motivated to learn and transfer skills	*Needs addressed by technology:* • Making skills more relevant to students' backgrounds and experiences by anchoring learning in authentic (e.g., real-life), highly visible situations • Addressing motivational problems by giving students active roles • Teaching students to work together through group-based, co-operative learning activities • Emphasizing engaging, interesting activities that call for students to learn higher-level and lower-level skills at the same time
Strategies used tend to: • Focus on teaching sequences of skills that begin at lower-level skills and build to higher-level skills • Clearly state skill objectives of learning activities and test items matched closely to them • Stress individual work • Emphasize more traditional teaching/assessment methods: lectures, skill worksheets, and activities and tests with specific "right answers"	*Strategies used tend to:* • Focus on posing problems, exploring possible answers and making presentations of findings • Pursue more global goals such as problem solving and research skills • Stress group work more than individualized work • Emphasize alternative learning/assessments: exploring open-ended questions and scenarios, using performance checklists, developing portfolios

Adapted from M.D. Roblyer, Jack Edwards and MaryAnne Havriluk, *Integrating Educational Technology into Teaching*, Merrill/Prentice Hall, 1997.

TABLE 2: TWO INSTRUCTIONAL MODELS FOR INTEGRATING TECHNOLOGY

The teacher, as instructional designer, determines which model to employ when and where in the curriculum. This decision also depends on a number of other variables, such as the number of computers available in a classroom or school, where the computers are located and accessibility.

"They [teachers] learned that technology is neither an instructional method nor a curriculum; rather it enables teachers to teach more effectively than they do when lecturing or engaging in other traditional methods in homogeneously grouped, discipline-bound classes" (Caverly *et al.* p.59).

Although models used in the past often heavily influence the instructional model chosen, we need to remember that technology is an empowerment tool. Integrating technology may require looking differently at how one organizes and delivers instruction. The Apple Classrooms of Tomorrow (ACOT) project and related research indicate that, over time, effective use of technology changed the role of the teacher in the following areas:

- beliefs and attitudes about the purpose and nature of instruction,
- interaction with students (moving away from lecturing and towards guiding or mentoring),
- use of co-operative and task-related interaction among students, and
- collegial sharing among teachers.

Hord *et al.* (1987), in *Taking Charge of Change*, say that management concerns become more intense at the final stages of preparing to use an innovation, as well as during the early period of use. As shown in Table 3, schools and jurisdictions in Alberta have addressed some of the pressing issues and questions.

Concerns	Some Solutions (Described in detail in Appendix D.)
How do I get time to do this?	• two forty-five minute periods for each child in lab on a six-day rotational basis; weekly in-service (Penbrooke Meadows School) • two forty-minute periods of classroom computer time for each child each week; computer lab booked (Dr. Morris Gibson School) • pairs of students scheduled to use classroom computers for two days at a time to complete projects (Kateri Mission Catholic School) • noon-hour HyperStudio computer lab (Banff Trail School [Bilingual])
Where will I get adequate resources, hardware, software and possibly print resources, to deliver this program?	• for 400 students, multimedia lab (seven computers), word processing lab (thirty computers), two computers per classroom, printers throughout school (Dr. Morris Gibson School) • one networked lab, word-processing lab (older computers), one to four computers per classroom (Lacombe Upper Elementary School)

	• for 360 students, twenty computers on Ethernet network, sixty other computers in school (Leo Usaak Elementary School) • 115 computers for 552 students: in the library, computer lab and classroom workstations (Mary Butterworth School)
➢ How do I arrange to have different students doing different things at the same time?	• two or three students work in groups at workstation during journal writing/silent reading period (Westminster School) • students assigned to computer time work during regular instruction times (Kateri Mission Catholic School)
➢ How do I include technology with all of the other things that I must cover in the curriculum?	• integration into social studies, language arts, mathematics, science and art instruction (Westgate School) • word processing for a specific writing purpose (Dr. Morris Gibson School) • grade 9 students automatically enrolled in CTS technology program; expectations for technology-focused work in academic areas (Highwood School) • students trained as "experts" to assist peers with e-mail, Internet, HyperStudio and classroom web page (Kateri Mission Catholic School) • special computer classes (Mary Butterworth School)
➢ What other resources, technical or otherwise, are needed?	• student files or diskettes for saving personal work • software, paper and pencil, books or reference materials • other technical equipment such as scanner, printer, headphones, LCD panel, TV screens

TABLE 3: WAYS TO ADDRESS IMPLEMENTATION CHALLENGES

The nature and kind of change and, especially, the amount of assistance provided directly affect the pattern and intensity of concerns people experience during a period of change. Integration of technology into the curriculum can represent an enormous order of change for teachers, not only personally as they try to acquire the new skills and knowledge they need, but also in their classroom lesson designs, procedures or organization and assessment.

To deal with these concerns, teachers need:

- problem-solving and sharing sessions where classroom vignettes or models are discussed or presented,
- abundant opportunities to share management resolution strategies, and
- opportunities to internalize the changes in classroom organization and structure that might be required for successful integration.

Bailey and Lumley (1994) identify ten new technology-based learning methods:

1. *Teacher talk with text and technology.* Computer software and other technologies are used in classroom interaction/demonstration.

2. *Integrated learning systems.* Integrated hardware/software management systems provide computer-based instruction. Lessons are integrated with the curriculum, and courseware often spans several grade levels.

3. *Multimedia learning.* Hardware and software have the ability to input, manipulate and output graphics, audio and video.

4. *Electronic co-operative learning.* Students work together electronically to achieve a common learning goal. The four essential elements of co-operative learning are evident: individual accountability, interpersonal skills, small-group skills and group processing. Face-to-face interaction may be replicated electronically.

5. *Electronic collaborative learning.* Large numbers of students work together electronically on a single project or product. Students usually have their own computers but are networked so they all can focus on one project or product simultaneously.

6. *Computer lab/networked lab.* Students all use the same software to achieve specific instructional purposes; e.g., skill and drill, productivity and research-based software.

7. *Hypertext/hypermedia.* Students create or use multi-layered text with connecting links and possibly graphics, sound and video.

8. *Electronic gaming/simulation.* Software emulates real-world activities and occurrences to promote student learning.

9. *Electronic distance learning.* Students learn by using computers and modems to communicate with other students, experts, databases, etc.

10. *Virtual reality.* Learners gain vicarious experience by exploring artificial worlds in a computer memory bank or software.

There are endless possible classroom applications of technology. Each requires an understanding of the process and experimentation with the changed learning environment.

CURRICULUM INTEGRATION

The jurisdiction and school vision included in the three-year technology plan should clearly identify what is to be achieved.

A **thematic approach** not only resolves some of the *time concerns* but also provides more authentic and meaningful learning experiences. With a thematic approach, students often have opportunities to explore areas that interest them. Such activities also lend themselves to culminating projects and opportunities for students to present and share their learning in numerous ways.

The themes chosen should be broad enough to accommodate several curriculum and technology outcomes. For example, data collection in science may be related to database/spreadsheet instruction in math.

At times, discrete teaching might be necessary to meet outcomes that are difficult to integrate; e.g., keyboarding.

Project-based or problem-based learning enables students to demonstrate their abilities to gather and manage information. They make numerous important decisions as they develop their projects. Projects also allow all students to participate in some meaningful way. Most curricula incorporate a problem-solving model or an inquiry approach to learning that provides a framework for activities designed to teach learner outcomes in technology.

The "**curriculum within a curriculum**" approach involves revising existing unit(s) of study to embed technology outcomes where appropriate. Teachers closely review how the knowledge, skills and/or attitudes in each program are related to the learner outcomes for technology. The outcomes include: 1) foundational operations, knowledge and concepts; 2) processes for productivity; and 3) communicating, inquiring, decision-making and problem-solving outcomes.

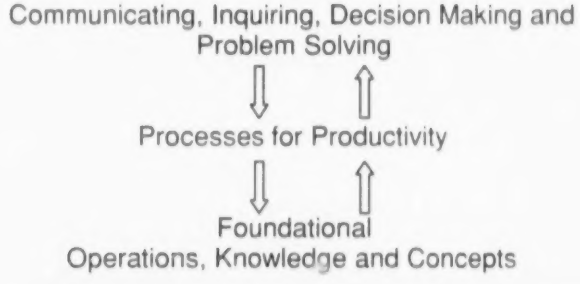
Communicating, Inquiring, Decision Making and Problem Solving
Processes for Productivity
Foundational Operations, Knowledge and Concepts

FIGURE 1: KEY CATEGORIES FOR LEARNER OUTCOMES IN TECHNOLOGY

A teaching unit that begins with a curriculum-driven unit of inquiry, decision making and/or problem solving may require students to apply productivity techniques and tools that need basic computer skills and knowledge of telecommunications and/or multimedia technology operations. A unit that begins at the foundational level (for example, the role

of technology in work and society) may go on to a decision-making process related to an issues-driven social studies assignment.

RESOURCES

Identifying the specifications and type of computers to be purchased should be the *last question* asked in the planning process. Until jurisdiction or school staff decide what is to be accomplished in the curriculum with technology, they can not answer questions about technical equipment or hardware. The first job is to determine where and how learner outcomes in technology will be achieved (see <http://ednet.gov.ab.ca/techoutcomes/ie>). Then comes the match between curricular goals and the *minimum* hardware/software required for achieving the goals.

SOFTWARE

"Educators ordinarily do little advance planning to determine what software is needed for teachers and students to use computers effectively in the classroom" (Middleton *et al.* p. 20).

To truly integrate technology into the classroom curriculum, jurisdictions and schools have to choose software for integrated use. Generally software can be divided into these specific categories:

- **productivity or application** software—word processing, spreadsheet, database, presentation software, multimedia, etc.,
- **problem-solving** software that uses critical thinking skills but is not always applicable to only one specific content area,
- **simulation** software that presents situations where students can solve problems or take risks as if in a real-life situation,
- **curricular support** software that re-inforces concepts and enriches learning experiences (generally found in school media or resource centre),
- **games** software, also called edutainment, that motivates students to achieve specific learning objectives,
- **tutorial** software that teaches interactively and decides when a student has completed enough tasks to proceed, and
- **drill and practice** software that provides practice in skills students have been taught previously or need to learn.

Software should be chosen to support the content and intent of the curriculum and enhance student learning. For example, drill and practice software may support the mastery of skills in a subject discipline but probably not the achievement of learner outcomes in technology. In integrating technology into the curriculum, teachers need to consider software as another resource for enabling students to achieve curriculum

outcomes while simultaneously choosing software facilitating the achievement of learner outcomes in technology.

Alberta Education has provincial licensing agreements, including the *Microsoft Education Select Master Agreement* and *ClarisPlus Master Volume License Agreement*, which provide special prices on productivity and application software products for all school jurisdictions. In addition, Alberta Education is preparing a call for software resources to identify resources that will help jurisdictions and schools achieve the learner outcomes in technology.

As teachers learn more about integrating technology, their software requirements are likely to change. Table 4 presents the choices made by a committee in the Lethbridge School District after reviewing the *Learner Outcomes in Information and Communication Technology, ECS to Grade 12: A Framework* (1997). This example is not intended as a recommendation for any particular software. However, this initial review has provided the district with a place to start in integrating technology across the curriculum. It also has helped the budget committee to determine software priorities.

Software Requirement	Division I	Division II	Division III	Division IV
Internet				
Access hyperlinked sites				
Navigate the Internet				
Use information retrieval technologies				
Web and home page development				
Keyboarding				
Word processing				
Clipart				
Spreadsheet				
Database				
Graphing				
Scientific calculators				
Scientific instrumentation				
Integrated software				
Desktop publishing				
Paint and draw				
Multimedia				
E-mail				
Other communication technologies (e.g., newsgroups, web browsers)				
Reference documents				
Graphic organizers				
Design and follow a plan				
Project or time management				
Presentation software				
Atlas				

Software Requirement	Division I	Division II	Division III	Division IV
Simulation software				
Scanning images				
Photography tools				
Computer-assisted drafting				
Career planning				
Antivirus checks				

* Developed by Integrating Technology into the Curriculum Committee, Lethbridge School District No. 51, December, 1997.

TABLE 4: SUGGESTED SOFTWARE REQUIREMENTS FOR INTEGRATING LEARNER OUTCOMES IN TECHNOLOGY

HARDWARE

Not all software applications require high-end, current or fast computer hardware. Older computer technology can be used for basic word processing, keyboarding instruction and practice, spreadsheet applications in mathematics, drill and practice and running other curriculum support software packages that do not require as much memory as multimedia software. On the other hand, collaborative work (such as projects involving on-line peer response groups or other students outside the classroom) requires Internet connections. Networking allows some older machines to be used to run e-mail and other telecommunication activities and leverage the sharing of other resources such as printers and software.

Schools need to define the minimum specifications required to meet the processes they will be utilizing to integrate technology into the curriculum. Since this may vary among subjects or even among units, hardware needs to be deployed flexibly, for example, relocated to other areas when needs emerge in a particular grade or classroom at a particular time. Use of expensive equipment should be maximized. Therefore, schools must plan to make the most of their hardware resources.

Location of Hardware

The location of hardware and/or space needs should be considered early in the planning process. The ***location*** of technology hardware and software strongly influences how it will be used and by whom.

Computers in a ***lab setting*** tend to be associated with scheduling students at the same time when the lab is available. With this approach, access and equity can become major concerns, especially in a large school. In addition, this approach encourages people to think of technology as a limited resource or tool in the instructional process. If instruction in the lab also is delivered by a designated "computer teacher," students often get the message that computers are not for all people nor are they a daily tool to be used in regular instruction. To be authentic tools for learning, computers must be on hand when the need arises, not when the lab is available in the next week or so. In some subject areas such as mathematics and science, "real" use of technology is difficult to carry out in a computer laboratory as additional equipment and space is often required for

experimental work; for example, the use of probeware—devices that take information from the environment and enter that information directly into a data file.

Locating hardware in or near a ***library or media centre*** may encourage a variety of applications. If additional staff (either library or computer teachers) are available to do co-operative planning and provide curriculum or technical support, a variety of applications might be possible; for example, instruction in how to use the technology and applying the technology in course assignments.

Placing computers ***both in labs and in classrooms*** makes resources available when and where students require them.

Computers in ***individual classrooms*** are convenient for teachers and students, but this approach limits access for others outside of that classroom. The number of computers in each classroom also determines the extent of use by students and the teacher. A one-computer classroom may be seen as a disadvantage, but with determination, creativity and scheduling, it can be a workstation or learning centre for one, two or even a small group of students; a teaching tool for large group instruction; and a personal secretary and record-keeper for the teacher.

Sharing computers between classrooms facilitates the optimal use and encourages teachers to plan and work collaboratively. This approach can contribute to the professional development of staff members.

Clusters of computers may be an option, for example five to eight high-end machines that can be used for specific purposes such as multimedia authoring.

Mobile computers provide more access and flexibility (Hancock, 1991). Small laptops, such as DreamWriters or AlphaSmart Computers, can be used for word processing.

The location of technology in the school should reflect the needs of the curriculum as well as the staff's instructional plan. Does your school need "centres" for discovery, small-scale classroom projects, research and computer-assisted instruction? Or do you need "mini-labs" or a "computer lab" for large group and/or whole-class instruction and projects? Or do you need some combination of both of these? (See also Alberta Education's *Network Design: Best Practices for Alberta School Jurisdictions*.)

Quantity of Computers

Alberta Education requires school jurisdictions to address equity of access to computers for students in their three-year technology plans. There are increasing demands for making more computers available for every subject area.

Clearly, school jurisdictions and schools have to begin their planning by identifying what is currently available. It may be desirable to have a high-end, multimedia machine at every workstation. However, such a goal is neither realistic nor necessary. Pentium processors are not required for word processing. Multimedia machines can be clustered for projects that require students to access graphics, audio and/or video/multimedia on the Internet, etc.

The idea that all children must have their own computers for any given activity is invalid. "Pairs, trios, and even larger groups of students can use a computer effectively if the staff develops the activity properly" (Middleton *et al.* 1977, p. 21).

HUMAN RESOURCES

"Effective use of technology ultimately depends on the knowledge and skills of the teacher, the person with the greatest impact on the classroom environment" (Thomas Payzant, p. 3).

Implementing learner outcomes in technology should not require additional teaching staff. However, implementation does require staff who feel comfortable with technology and/or are open to change and learning about the role of technology in teaching and learning. Staff development plans should therefore be based on the results of an assessment to determine staff needs.

Although the primary responsibility for teaching resides with certificated staff, **classroom assistants or aides** who have computer skills can assist teachers in classrooms or labs. Also, **high school students** in work experience programs or special projects can be classroom assistants.

Another type of support that many teachers find useful is having trained "classroom experts" in their courses. Before beginning a new project, teachers can train one or two students to help other students with the technical challenges of a particular software package or to assist in other ways. Using **student experts** as first-level trouble-shooters means fewer interruptions as the teacher works with other students. Kateri Mission Catholic School in Grande Prairie Roman Catholic Separate School District No. 28 has used this approach successfully.

Volunteers (parents, grandparents, seniors, business people and other community members) can assist the teacher with projects and lead small-group activities. For example, at Banff Trail School (Bilingual) in Calgary School District No. 19, parents help with a noon-hour HyperStudio Computer Club. Volunteers can:

- help students explore and search on the Internet,
- help with e-mail exchanges,
- help with students' projects,
- compile and transmit data for the teacher, students or class,
- find and suggest web sites and computer projects/activities,
- help to set up an instructional environment and make sure that the required equipment is available and working,
- locate resources, equipment, etc., that is needed for an assignment,
- construct and manage web pages,
- help to teach students technology skills, and
- help to train staff in technology skills.

PLANNING FOR STAFF DEVELOPMENT

Hord *et al.* (1987), identify six "stages of concern." They state that "the developmental and interactive nature of concerns is real and must not be ignored.... Concerns are influenced:

- by participants' feelings about an innovation,
- by their perception of their ability to use it,
- by the setting in which the change occurs,
- by the number of other changes in which they are involved, and most of all,
- by the kind of support and assistance they receive as they attempt to implement change" (p. 43).

"Technology does not teach students; effective teachers do" (Whitesel, p. 2).

"When engaged in any change process, teachers will have specific and individualistic concerns about the change and their involvement in it.... Concerns exert a powerful influence on the implementation of a change, and they determine the kinds of assistance that teachers find useful" (Hord *et al.* 1987, p. 30).

Since the single most important factor in the change process is the people who will be affected by that change, it is imperative to consider the concerns of teachers and recognize the stages they go through as they move towards implementing change. Professional development is effective when it specifically addresses the concerns of the learner and builds on the learner's current level of knowledge.

The significant questions related to the "concerns-based approach model" (CBAM) are open-ended. For example:

- When I think of using technology, I am concerned about....
- To implement this new program, I need....
- I would like to know more about....
- How would I...?

	Stages of Concern	Expression of Concern
	0. Awareness	I know very little about computers and do not use them either personally or professionally, even though I see technology looming on the horizon. I am somewhat technophobic.
SELF	1. Informational	I am a novice. I lack the knowledge and skill to make use of technology at home or in the classroom. I am concerned about learning more about the potential uses of technology in the classroom.
	2. Personal	I am beginning to make use of technology in my professional work, but am concerned about how using it will affect me personally as an educator.
TASK	3. Management	I am concerned about the amount of time needed to learn and keep up with the educational applications of technology. I seem to be spending all of my time learning about technology and preparing materials for technology integration.
	4. Consequence	I use technology, but am concerned about the effect my use of technology is having and should be having on student learning. How can I refine my approach to have more impact on student learning?
IMPACT	5. Collaboration	Occasionally I can help a colleague with a hardware/software issue. I am concerned about how to relate what I am doing to what others are doing in their use of technology in the classroom.
	6. Refocussing	I am comfortable with making routine professional use of technology and I have some ideas that would work even better.

Adapted from Hord *et al. Taking Charge of Change*, ASCD, 1987, and David Moursund, "Editorial on Professional Development," *Learning and Leading with Technology*, December–January 1997/1998, Vol. 25, pp. 4–5.

TABLE 5: CONCERNS-BASED APPROACH MODEL IN RELATION TO TECHNOLOGY INTEGRATION

Mandinach and Cline (1992) say that learners move through a developmental cycle in their use of technology in teaching and learning. They describe the cycle as stages of mastery of technology.

The **Survival Stage:** a struggle against technology, with concerns about unrealistic expectations and management problems, etc. This stage can be described as "chaos."

The **Mastery Stage:** coping strategies along with increased tolerance of new forms of interactions and classroom structures, and more engagement through increased technological competence.

The **Impact Stage:** a move to more learner-centred instruction. Teachers establish new working relationships and structures in the classroom and feel less threatened. Technology-enhanced curriculum is implemented.

The **Innovation Stage:** teachers experiment with using technology to enhance their instructional processes and achieve learner outcomes. This often results in the restructuring of curriculum and learning activities. At this stage, "technology across the curriculum" is achieved.

Adapted from E. Mardinich and H. Cline, "The Impact of Technological Curriculum Innovation on Teaching and Learning Activities," Paper presented at American Educational Research Association (AERA), 1992.

FIGURE 2: STAGES OF MASTERY OF TECHNOLOGY

Concerns are not fixed. People move through these stages of concern if they receive appropriate support and assistance. Staff development should address concerns and help them refine their use of technology in the curriculum. Once **personal issues** are addressed, **management issues** probably become the next highest level of concern. After these issues are addressed, **impact issues** will come to the fore, and so on.

ASSESSING PROFESSIONAL DEVELOPMENT NEEDS

Starting with the school's vision of the direction it will take in implementing technology, administrators can develop a list of questions to ask in a needs survey. Open-ended

questions often will yield more useful information. Although staff needs within schools will vary as much as staff needs across schools, it is important to work with all staff at their levels of comfort and institute a long-term plan to support them and help them grow professionally.

MEETING INDIVIDUAL NEEDS

Teachers will likely choose to address technology integration through their Annual Teacher Professional Growth Plan. Resources will need to be available to encourage and support them as they pursue their individual learning goals.

Although different schools and jurisdictions approach staff development in different ways, there are important similarities. For example, most staff development occurs on site, with several options; for example, collaborative planning for technology integration, mentoring and coaching in the classroom, inter-classroom visitations. Ease of access and flexible content, structure and processes are important factors in meeting the diverse needs of staff.

"Learning organizations are organs, where people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspirations are set free, and where people are continually learning how to learn" (Senge, p.3).

"Because technology changes rapidly, technology training is an ongoing need—not a short-term fix" (Caverly *et al.* 1977, p. 56). Staff development begins with basic skills (how to use technology) but moves on to integrating technology into instruction, curriculum and students' learning processes. Staff development in technology must be embedded into the design of most curricular in-service and staff development programs over the long term.

ASSESSING PROGRESS

The goal of implementing the *Information and Communication Technology, Kindergarten to Grade 12: An Interim Program of Studies* is likely to feature prominently in a school or jurisdiction's three-year technology plan. The most significant indicator of success in achieving this goal will be the extent to which students achieve the learner outcomes that have been defined. In this regard, Alberta Education is developing a framework for assessing student performance of the technology outcomes. The framework will address issues such as:

- purposes for assessment,
- principles of assessment,
- assessment strategies,
- performance-based assessment,
- assessment in a cross-curricular environment, and
- assessment within the high school program.

In the first phase of this project, two assessment tools for classroom use will be developed—one for Division II and one for Division III. These tools will provide a means of determining how well students are achieving the technology outcomes in a variety of subjects and contexts. These assessments will be able to provide diagnostic, formative and summative information for students and teachers. Collected in a portfolio and communicated with a profile for each student, these assessments are intended to provide valuable feedback about a student's progress, and by extension, feedback to teachers, administrators and parents about the progress of the technology program. In phase two, assessment tools will be developed for Divisions I and IV.

Another very significant indicator of success will be the degree to which teachers embrace technology and are able to seamlessly integrate it into the teaching and learning environment. Measures might include the number and variety of applications used, comfort level with the use of information technology, and the extent to which teachers engage in related professional development. Annual Teacher Professional Growth Plans can provide teachers with a valuable way of addressing and monitoring (through reflection and self-assessment) their own technological literacy while at the same time, supporting the school or jurisdiction plan.

The assessment tools for student achievement described above are expected to provide guidance for instructional and technology planning. They also should provide teachers with a clearer understanding of curriculum expectations and standards and administrators with a better understanding of the professional development needs of their staff. In the face of rapid technological change, schools, jurisdictions, and teachers (through their ATPGP) will need to revisit their technology plans to confirm that they are still on track or to chart new directions.

For students and teachers alike, the ultimate measure of progress with the integration of information and communication technology will be the extent to which students can demonstrate the seamless and appropriate application of their technology skills and

knowledge to identify and solve problems, conduct inquiry and research, make decisions, collaborate and communicate.

FINDINGS AND CONCLUSIONS

The purpose of implementing the learner outcomes in information and communication technology is to ensure that all students in Alberta have the knowledge, skills and attitudes they need for entry-level work, for further study and lifelong learning. The most critical element in achieving these goals is planning. Plans will vary, and they will be initiated at different levels (by teachers, by schools and by jurisdictions), but in each case they should involve stakeholders in a collaborative process.

A second major component of implementation is professional development. Again, there is no single ideal approach.

However, teachers' concerns about technology are real. They need to be addressed. Teachers may have personal, management or impact issues to resolve. Change is not always orderly, linear or predictable, and it is certainly not final.

McNabb (1996) found that acquiring hardware is a primary consideration in the first stage of implementation. At this early stage, the computer is seen simply as a tool to complete a task such as writing. In contrast, at the advanced stage there are changes that affect the teaching and learning environment to such an extent that entirely different course structures or models of delivery emerge. At this stage, the computer becomes a tool for thinking, a tool "...that inspires generation, exploration, and synthesis of novel ideas into linguistic expression" (Pennington, 1993, p. 67).

Therefore, professional development focussed on how to use various technology tools must be presented in the context of students' use of these tools to facilitate higher-order thinking skills. Teachers need to learn how to develop student tasks and activities that will facilitate student learning of the technology outcomes across a variety of subject areas.

Implementation is not easy and it requires time for learning. Concerns must be resolved, teachers need to be encouraged to be flexible and they need access to resources.

> *"No one can predict the future, but we do know that our students will need to think critically and strategically to solve problems. To plan for the future, we must have a vision of what students will need, how the learning environment will be structured, and what the role of the teacher will be within this environment.... We cannot justify technology for the sake of technology. The greatest challenge in technology planning perhaps lies in how technology may best be used for learning. It matters little if we have state-of-the-art equipment if we do not have state-of-the-art classrooms"* (Addison School District 4, Blueprint for Learning, 1995, p. 42).

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APPENDIX A
WHAT ALBERTA EDUCATION REQUIRES

Alberta Education requires all school jurisdictions to have a three-year technology plan (*1998/1999 Funding Manual*, Section 1.A.12, Technology Integration). Schools also are required to develop plans that align with their jurisdiction's plan.

Alberta Education's February 1997 draft handbook for school board technology planning suggests that a jurisdiction address several components in building its technology plan. Most of the components mentioned focus on technical aspects as opposed to teaching and learning with technology.

"If computers are going to be used to positively impact student learning, then we need to recognize that educational vision, goals, methods, tasks and resources including hardware and software need to be aligned so that they are congruent with each other" (Valdez and McNabb, p. 1).

Since technology is only one aspect of a jurisdiction's overall education plan, in April, 1998 Alberta Education released a document entitled *Developing A Three-Year Technology Integration Plan: A Resource for School Jurisdictions*. This document focusses on providing suggestions for integrating technology into education by linking closely with the school board's three-year education plan and annual education results report, thereby recognizing that the jurisdiction's technology plan is part of a much larger picture. The April, 1998 document states that the key elements of a three-year technology plan are the same as those of a board's three-year education plan, namely:

- Vision
- Policy statements
- Goals
- Results, performance measures and strategies

"A successful education program begins with a strong vision. A vision gives you direction, forward momentum, and an opportunity to create an innovative program. Planning based simply on problem solving keeps you firmly rooted in the present. In contrast, planning based on a vision lets you take today's needs into consideration while keeping an eye on the future. Good planning encourages individuals to question their beliefs and examine key issues" (Teaching, Learning and Technology, A Planning Guide. Apple Education Series, p. 1-1).

Like all plans, a technology plan begins with an idea, a vision or an impression of what a jurisdiction is committed to achieving in technology—"where it wants to be, what students will achieve, and what services and programs will look like" (Valdez and McNabb, 1997, p. 5). One of the indicators of a successful school is clarity of vision (direction) and purpose, or specifically in this case, understanding of the impact of technology on the lives of students and how schools can prepare them for the future.

Alberta Education's *Information and Communication Technology, Kindergarten to Grade 12: An Interim Program of Studies* (June, 1998), scheduled for provincial implementation in September 2000, "identifies not only the outcomes that are already included in current programs of study, but also anticipates the knowledge, skills and attitudes that students will need to develop as

technology continues to rapidly change" (p. 3). Administrators' and teachers' understanding of those outcomes and the program's intent is crucial.

Developing a Three-Year Technology Integration Plan advises school jurisdictions to implement their proposed strategies "over time" by setting priorities and "planning to take certain steps in an appropriate sequence" (p. 20). It also suggests that, to be successful, boards consider:

- identifying all **input** resources (human, capital) required to implement each step, including who is responsible for each action or step
- identifying the completion year (**when**) for each action or step, including milestones along the way, and indicating what **evidence** will be provided to demonstrate completion
- developing a logical sequence of actions or steps (**how long**)

APPENDIX B
RELATED ALBERTA EDUCATION RESOURCES

Alberta Education Programs of Study. Available: <http://ednet.edc.gov.ab.ca/studentprograms/>.

Computer Network Security: Best Practices for Alberta School Jurisdictions (1999).

Developing A Three-Year Technology Integration Plan: A Resource for School Jurisdictions (1998).

FOIPP and Technology: Best Practices for Alberta School Jurisdictions (1999).

FOIPP and Technology Highlights: Best Practices for Alberta School Jurisdictions (1999).

Illustrative Examples to Accompany Information and Communication Technology, Interim Program of Studies, Grade 1 to Grade 6 (1998).

Illustrative Examples to Accompany Information and Communication Technology, Interim Program of Studies, Grade 7 to Grade 9 (1998).

Illustrative Examples to Accompany Information and Communication Technology, Interim Program of Studies, Grade 10 to Grade 12 (1998).

Implementing and Managing Web Site Development in Education: Best Practices for Alberta School Jurisdictions (1999).

Information and Communication Technology, Kindergarten to Grade 12, Interim Program of Studies (1998).

Managing Technology Funding: Best Practices for Alberta School Jurisdictions (1999).

Network Design: Best Practices for Alberta School Jurisdictions (1999).

On-Line Learning: Best Practices for Alberta School Jurisdictions (1999).

Professional Development for Teaching Technology Across the Curriculum: Best Practices for Alberta School Jurisdictions (1999).

Technical Support Planning: Best Practices for Alberta School Jurisdictions (1999).

Technology Implementation Review, Grande Yellowhead Regional Division No. 24 and Wolf Creek Regional Division No. 32: Best Practices and Key Learnings with Respect to Technology, Its Implementation and Management in Education (1997).

TELUS Learning Connection: An Educational Internet Alliance Web Site. Available: <http://www.2Learn.ca>.

APPENDIX C
ALBERTA BEST PRACTICES
PROJECT TEMPLATE

TEMPLATE FOR SCHOOL OR CLASSROOM CASE STUDIES

IMPLEMENTATION MODELS FOR LEARNER OUTCOMES FOR INFORMATION AND COMMUNICATION TECHNOLOGY

School: Elementary _____ Middle _____ Junior High _____ Senior High _____

Location: _____

Key Contact: _____

Description of school: (including socio-economic description, size of school, size of staff, technical competencies, technology—type and quantity—available in the school and how it is deployed and how/when it was purchased, etc.)

School vision of technology use/integration:

Length of time the school has focused on achieving this vision:

Description of what technology integration looks like in your school: (description should include specific grade level expectations, instructional model, instructional time required and how timetabling occurs, human resource strategies and deployment to achieve technology integration, instructional software availability and utilization, other support resources utilized, etc.)

Staff development (What has occurred and what is next?):

Challenges faced or anticipated? How they were or might they be overcome?

What impact will the learner outcomes in information and communication technology have on your school technology vision for the next three years?

How will you assess student and staff progress in implementing/achieving the learner outcomes?

TEMPLATE FOR JURISDICTION CASE STUDIES

IMPLEMENTATION MODELS FOR LEARNER OUTCOMES FOR INFORMATION AND COMMUNICATION TECHNOLOGY

School Jurisdiction: _____

Location: _____

Key Contact: _____

Description of jurisdiction: (including socio-economic description, size of jurisdiction, number of teaching staff, technical competencies, technology—type and quantity—available in the schools and how it is deployed and how/when it was purchased, etc.)

Jurisdiction vision of technology use/integration of technology into the curriculum:

Description of how the vision was developed; i.e., decision-making model and involvement of stakeholders in the visioning process:

Length of time the school jurisdiction has focused on achieving this vision (and in your view has the jurisdiction achieved the vision):

Description of what technology integration looks like in your jurisdiction: (description should include specific jurisdictional grade level expectations, instructional models, instructional time requirements, human resource strategies and deployment to achieve technology integration, instructional hardware and software availability and utilization, other support resources utilized, etc.)

Staff development (What has occurred, how has it occurred and what is next?):

Challenges faced or anticipated? How they were or might they be overcome?

What impact will the learner outcomes in information and communication technology have on your jurisdiction technology vision for the next three years?

How will you assess student and staff progress in implementing/achieving the learner outcomes?

APPENDIX D
EXAMPLES OF BEST PRACTICES

BANFF TRAIL SCHOOL (BILINGUAL)
CALGARY SCHOOL DISTRICT NO. 19

Synopsis

"Round Robin Method" (Peretti, 1997*) is used in a noon-hour club to teach grade 5 students how to use HyperStudio on seven Macintosh computers. Parent volunteers work with a teacher for forty minutes a week to teach the basic skills of using multimedia to write a "Choose Your Own Adventure" story. Students enjoy the opportunity to see other students' work and ideas, and are challenged to try new techniques.

Contacts: Gail Niinimaa and Dale Lamont

Description of Project

- Noon-hour HyperStudio computer club in first and second terms
- Seven pairs of grade 5 students chosen on a first-come, first-served basis
- Each pair agreed to work together and come for the duration of the club
- A substitute could replace an absent student
- Two parent volunteers
- First term saw a forty-minute noon-hour club run for eight weeks with length of program increased to nine weeks in second term
- Club ran on seven Macintosh LC 475s or higher computers available using HyperStudio 3.0

Rationale for Club (Vision)

- Allow a more systematic approach to teaching HyperStudio skills in a short time frame
- Students have more freedom and time to critique design aspects of their work (Round Robin removed individual responsibility for how it looked)
- Method sounded as if it would be a fun way to teach this program

Operation of Club (What Technology Looks Like)

- At first meeting, students were introduced to multimedia, followed by a brief discussion about "Choose Your Own Adventure" stories
- Students presented with a variety of story starters
- In pairs, students taught how to add a text object and wrote a title for the story

* Peretti, Jonah H. "The interactive story: Fostering School Community Through Multimedia Projects" in *Educational Multimedia/Hypermedia and Telecommunications*, 1997, Volume II, ED-MEDIA/ED-TELECOM 97 World Conference on Educational Multimedia/Hypermedia Proceedings, Association for the Advancement of Computing in Education.

- Students changed computers and learned how to modify a text object, change font, size, etc. of the title
- Changed computers again and this time added a new card and button objects to move from card to card
- Changed computers often, adding/modifying text, buttons, graphics and sound
- Completed a four-card "Choose Your Own Adventure" story
- Students examined what they had done and developed the stack structure/storyboard for the story
- Frequency of the moves from one computer to another lessened near the end of the project
- Pairs became responsible for the total creation of the entire card
- Students completed an in-depth evaluation and critique of their original stack
- Students followed evaluation guidelines for assessment of font, size, style, placement of graphic objects, etc.

Challenges Faced/Anticipated

- Two areas of concern:
  - some students had difficulty structuring the story so that it could plausibly branch into two paths
  - the "virus factor;" i.e., one pair can negatively influence the direction of a "Choose Your Own Adventure" on several computers
- Stricter guidelines implemented re the use of other students' names and violent themes
- More paper planning required (title, first paragraph, the two choices)

Learner Outcomes

- Students learned to:
  - add and modify text objects, buttons including transitions and sound, graphics
  - use the drawing tools
  - stack structure
  - add and delete cards and move between cards without buttons
  - use the scanner

Assessing Progress

- Students felt they had "learned lots" and enjoyed the program
- Divided opinions re Round Robin and individual project method
- Enjoyed opportunity to see other work and ideas, but did not like having their story ideas "messed up"
- Recognized that certain fonts and colour combinations are hard to read
- Realized that text blocks should fit within text from the story
- Story should follow its title
- Round Robin structure allowed them to systematically master the basics of the program while using their observation skills to critique and design elements within the finished stories

DR. MORRIS GIBSON SCHOOL
FOOTHILLS SCHOOL DIVISION NO. 38

Synopsis

Staff of this K–6 school have been working towards integration of technology for four years. This "technology-rich" (4.5:1 student/computer ratio) school deploys technology according to the applications (programs); i.e., a high-end multimedia lab with seven computers and other technical equipment is used for appropriate purposes and a lower-end lab is used for word processing (386s and 486s). Two computers are available in every classroom, and printers are located throughout the school. A computer literacy scope and sequence chart was developed before Alberta Education published its learner outcomes document.

Contacts: Donna Gordon and Barbara Martin

Description of School

- Opened in 1993; most hardware purchased then with a few multimedia machine upgrades each year
- Thirty-five staff serving 400 students; students have a mixture of socio-economic backgrounds, ranging from high to very low
- One lab with thirty computers for word processing plus one lab with seven computers for multimedia (scanner, digital camera, Proxima, and Internet access)
- Sixteen classrooms, each with two computers; library has two computers and staff room has one
- Half of computers are 386s and other half 486s; twenty-four CD-ROMs; eight printers throughout the school (four pods each with one, multimedia has two, library and office one each)
- Computer system for live television and videos in each classroom
- Teacher expertise ranges from beginner to medium level, but all willing to learn and supportive of technology

School Vision of Technology Use/Integration

- Integration of technology in every classroom at all levels
- Develop curriculum components of learning, presenting and reinforcing through technology
- Students gain the knowledge and expertise to incorporate technology into all aspects of their learning, presentations, etc.

Length of Time School Has Focused on this Vision

- Since opening in 1993

What Technology Integration Looks Like in the School

- Two labs booked through library on a monthly basis
- No daily computer teaching time

- Two computers in each classroom to complement the curriculum
- Students "surf" school for other available computers when needed
- Two teachers work directly with staff on knowledge of software and integration through projects
- Expectations at each grade level as to what to focus on; taught as part of a project, not in isolation
- Instructional software networked with enough licences for lab and classroom settings
- Technology component in every teaching unit

Staff Development

- First year focused on multimedia through after-school development; staff attended computer conference in Calgary
- One year devoted to using multimedia devices
- Teachers and students currently learn about software programs in class through team teaching and planning format

Challenges Faced/Anticipated

- Learning curve is so fast that existing technology and available programs being outgrown
- Can not afford to upgrade technology and software at a fast enough pace

Impact of Release of Learner Outcomes Document

- Developed criteria for scope and sequence a year ago, continually updating
- Provides focus and reassurance that outcomes are being met
- Helps to narrow down technology plan to a workable level in the classroom so it does not become another add-on
- By 2000, school will have the document firmly in place, but this will continually change as students learn

Assessing Progress

- Continual outgrowing of software and hardware signifies success
- Students becoming self-directed learners; successful assessment on exams indicates success of program
- No longer having to plan for technology integration (it becomes automatic) a measure of success
- Staff supportive of technology, spending time and money for professional development

DR. MORRIS GIBSON SCHOOL
FOOTHILLS SCHOOL DIVISION NO. 38
GRADE 4/5 CLASSROOM

Synopsis

A teacher uses observational checklists, co-operative work and product assessment to assess student performance. Each child is assigned forty minutes of classroom computer time per week in addition to the teacher booking the computer lab for classroom projects. The teacher tries to have the learners involved in purposeful technology use.

Contact: Pauline Millard

Description of School: See previous entry.

School Vision of Technology Use/Integration

- Involving students in technology that is as purposeful as possible

What Technology Integration Looks Like in the Classroom

- Each child has two forty-minute periods a week to work on specific skills or programs; lab also booked for class topics for four to six periods a week, depending on availability
- Keyboarding skills required at the beginning of the year; then move into word processing for a specific writing purpose
- Rest of year is for major projects such as PowerPoint, drill and practice (one month) or curriculum-related activities
- Students sign up to use labs during recess, lunch time and free periods
- Year begins with a recap of the basic background to the computer components and rules for their proper use
- Major topics (word processing, multimedia, Internet use, databases and spreadsheets) covered throughout year

Challenges Faced/Anticipated

- Time in the lab is sometimes limited; some parts of the network occasionally go down
- As competency and therefore use increases, the time issue grows
- Need to plan year in more detail to maintain viability
- More money needed, especially for school-level support

Impact of Release of Learner Outcomes Document

- Already has a good grasp, but will need to incorporate a few new outcomes
- School definitely committed to using technology to better student learning
- Document will change as quickly as technology changes

Assessing Progress

- Students responsible with their work and helping each other as needed
- Ongoing assessment
- Students' and teachers' comfort and willingness to take risks
- Dialogue with each other and the teacher
- Observational checklists and finished products

HIGHWOOD SCHOOL
FOOTHILLS SCHOOL DIVISION NO. 38

Synopsis

This junior/senior high school has movable classroom computer workstations and two labs. Each subject area teacher is expected to make use of available technology. The school has a "tech support" person to maintain the school network and assist individual teachers with ongoing issues.

Contact: Jerry Blake

Description of School

- Opened in September 1996; grades 9–12 with 600 students
- Full academic program plus technology courses, band, drama and CTS
- Serves community of 6000 with strong community focus
- School planned with vital technology component: 160 networked machines in two labs plus two to four movable networked stations in each classroom

School Vision of Technology Use/Integration

- Expectation that technology will be used as much as possible in each subject and classroom
- Innovative projects encouraged—Nelson Math, Internet use, word-processed assignments, PowerPoint presentations, etc.
- School staff always involved in planning for ongoing technology, which expands and evolves each year

Length of Time School Has Focused on This Vision

- Since school opened; vision examined regularly

What Technology Integration Looks Like in the School

- Grade 9 students automatically enrol in technology program in CTS, which also is offered to all other students
- Academic subject areas have expectation for technology-focused work from students
- Discussed, organized and began planning for implementation to meet government directives
- Most students see computers as a tool, but initial euphoria has waned

Staff Development

- Individuals encouraged to take courses, attend professional development sessions, serve on committees, etc. to ensure awareness level, motivation and knowledge base
- Division offers ongoing courses and a technology support team serves all schools
- Technology support person in school maintains network, and assists individual teachers

- Individual progress and level of use is modelled rather than mandated
- Integration is ongoing, not "magic pill"

Challenges Faced/Anticipated

- Maintaining viable system in face of constant change is virtually impossible
- Obsolescence occurs roughly every six months—"How do we cope with this?"
- Only two to four students can access a computer at one time
- Difficult to balance time required to learn and adjust to technology use while preparing students for achievement tests/diploma exams
- Independent learning which seems to evolve not appropriate for all students

Impact of Release of Learner Outcomes Document

- Impact significant as it is government mandated
- Equipment, learning models, time and size restraints need re-examining
- Need for government investment

Assessing Progress

- Continue to monitor what we are doing, state of equipment, student reactions, etc.
- Monitor number of students using computers to write achievement and diploma essay exams; number of students who continue on with further CTS technology courses

HORIZON SCHOOL DIVISION NO. 67

Synopsis

In this small rural jurisdiction, a full-time teacher trainer travels to all schools during school hours, on a rotating basis. A special technology-training fund has been established for teachers.

Contact: David Walters

Description of Division

- 3500 students and 210 teachers; sixteen schools plus twelve Hutterite colonies and one outreach centre
- About 80 per cent Windows 95 and 20 per cent Macintosh
- Local area network with servers in five schools and peer-to-peer networks in remaining schools for file and print sharing
- Internet, web space and e-mail access provided by the University of Lethbridge

Vision of Technology Use/Integration

- Having students acquire skills and knowledge in the application of technology
- Computer labs and computers in libraries and classrooms
- Technology integrated into the regular curriculum as well as into CTS
- Technology committee operating for several years, evolving as new technology options appear, will continue to evolve

What Technology Integration Looks Like in the Division

- Computers leased over three-year term and expected to be evergreened over a six-year period
- Internet access on several computers in each school
- Students and teachers provided with unlimited access time
- E-mail accounts for all students and teachers
- Standardizing around Windows 95, with Microsoft Office 97 as core productivity software

Staff Development

- Full-time teacher trainer travels to schools on a rotating basis during regular school hours
- Sign-up sheet for teachers in the staff room to have trainer work in the classroom with teachers and students on real-time learning activities
- Trainer available to schools for traditional workshops and in-service training, usually during school hours
- Training funding of about $150 per teacher during 1997/1998 school year
- Teachers attend workshops, conferences, etc., but mainly paid for substitute teachers while spending time with travelling teacher trainer

Challenges Faced/Anticipated

- Progress towards better integration of technology a slow process
- Great need for ongoing personnel support and new job descriptions to achieve the technology learner outcomes

Impact of Release of Learner Outcomes Document

- Division had defined expectations for grades 3, 6, 9 and 12 before Alberta Education's learner outcomes published
- In 1997/1998, school committee modified learner outcomes to align them with Alberta Education's; skill level target and achievement standard set for the year based on these revised outcome goals

Assessing Progress

- Survey at end of 1996/1997 school year determined percentage of students who had met outcomes; data used to determine students' current skill level
- Surveyed again at end of the 1997/1998 school year
- Outcomes not addressed through these goals to be covered through the TELUS Learning Connection and additional school initiatives
- Plans to progressively include more learner outcomes in performance goals for students from 1998 to 2000 (but these should not be measured through tests)

HUNTING HILLS HIGH SCHOOL
RED DEER SCHOOL DISTRICT NO. 104

Synopsis

A media and curriculum specialist helps teachers in grades 6–8 in this middle school to integrate technology across the curriculum through a collaborative planning process. Together, they incorporate the use of information technology resources and approaches to achieve the technology learner outcomes. In addition to planning, this media specialist often assists/mentors the teacher in the technology teaching of the unit in the computer room attached to the library.

Contact: Elizabeth Fargey

Description of School:

- Middle school, grades 1–9
- Computer lab off the library
- Team meetings held every second day (three levels—grades 6, 7 and 8); curriculum co-ordinator tries to attend

Position Responsibilities

- Selects materials for library and professional centres based on curriculum needs
- Works with classes that need help in the library—research skills and computer applications
- Organization and maintenance of library facility
- Co-operative planning units with teachers, inclusion of technology where possible

Program/Services

- Provide training, teaching/learning resources and reference/research services for students and staff
- Team with teachers to determine information resources, learning strategies and design of instruction
- Help teach the skills necessary to meet these objectives
- Teach students Geograph and HyperStudio and help with introduction to ClarisWorks
- Keep all schools current and consistent re equipment, software and services
- Facilitate communication among staff to know what others are doing
- Administer and co-ordinate computer-based circulation and AV equipment
- Provide staff assistance in all aspects of AV materials, ordering, collection and circulation

Staff Development

- Meet with teachers on planning days and try to provide resources and strategies for forthcoming units

- Conduct training sessions for technology integration, sometimes directly teaching programs such as Geograph or HyperStudio or ClarisWorks introduction
- Act as a mentor, coach or classroom assistant for teachers who feel uncomfortable with technology
- Provide, maintain and develop a professional library to help staff with program development

Challenges Faced/Anticipated

- Monitoring Internet for resources/sites
- Staying current on technology software and practices
- Keeping a flexible timetable for common meeting and instruction time to work with teachers
- Co-ordinating and communicating programs and what others are doing within a school in the area of technology integration and use of technology
- Long/short-range planning, budgeting, operation and evaluation
- Understanding current library automation (critical)
- Human relation skills for interacting with teachers, students, parents and the community

KATERI MISSION CATHOLIC SCHOOL
GRANDE PRAIRIE ROMAN CATHOLIC SEPARATE SCHOOL DISTRICT NO. 28
GRADE 6 CLASSROOM

Synopsis

A district "Discovery" classroom has two high-end computers connected to the Internet and one Macintosh SE owned by the teacher. There also is a pod of four high-end computers in the library and one older Mac lab running ClarisWorks 2.0 for large group assignments. This teacher integrates technology projects into the curriculum and trains students as "experts" to assist others with projects such as e-mail, Internet, HyperStudio and a classroom web page. Each pair of students is scheduled to use the classroom computer for two days at a time.

Contact: Nikki Cale

Description of School

- Each "Discovery" classroom in the division is given one or two high-end computers
- Teachers submit proposals for projects for these computers
- School library has a pod of four high-end PC computers that are connected to the Internet
- School has an older Mac lab of thirty computers used for word processing or projects that can be accomplished with ClarisWorks 2.0

Preparations

- Students trained to be class computer experts (four sets of experts) for e-mail, Internet guides, HyperStudio, class web page
  - teacher reviews manual with expert pair so they can use it as a reference
  - teacher provides a quick rundown on program (what it does/how to use it)
  - teacher explains the project to be worked on and teacher's expectations (use of page space, adding buttons and other links, text and spelling, etc.). These expectations also are listed at the computer.
  - students are given lots of time to explore, make some pages, get comfortable with program, etc.
  - experts love this and use all available time plus want to stay in at lunch, etc.
  - experts usually feel ready the next day
- Experts share the project with the rest of the class
- Each pair of students chooses a topic that can be summarized and presented on one page
- Each pair makes a picture and writes the text on loose-leaf paper for teacher to check

What Technology Integration Looks Like in the Classroom

- Each pair is scheduled on the classroom computer for two days. (This time also must be used to complete other computer-related assignments such as e-mail communications.)
- Computer time for each pair is rotated throughout the day during regular instruction times
- Teacher has students' passwords for all e-mail accounts
- All work is saved and finished projects available on portable computers in the hall for parents and others to view

Examples of Successful Projects

- Our Solar System (HyperStudio); Brazil (PowerPoint/Internet); Music Awards in French (Davidson Multimedia); other small projects (variety of software and services)

Challenges Faced/Anticipated

- As long as a month for all to finish; could access other computers in the library
- Review topics to avoid overlap
- Adding sound would be good
- Keeping all busy and interested while only two are on the computer
- Using after-school time for extra help for more difficult aspects

Assessing Progress

- Experts are excellent resource people, little need to interrupt the teacher, confident technology users
- Students love the projects, work with enthusiasm and take ownership
- Positive feedback from the displays
- Rubrics for evaluation

LACOMBE UPPER ELEMENTARY SCHOOL
WOLF CREEK SCHOOL DIVISION NO. 72

Synopsis

One networked lab is designated for project-based learning, a lab with older computers is used for word processing and there are between one and four computers in each classroom. Two part-time technology co-ordinators work collaboratively with teachers to plan units, conduct research, and evaluate and purchase software. They facilitate staff development through one-on-one support consultation and formal and informal school-based professional development.

Contact: Ron Eberts, Technology Co-ordinator

Description of School

- Students in grades 3 to 6, combination of English program and French Immersion; some split grades; most students in the town in grades 5 and 6 attend this school
- Town has a mixed socio-economic background
- Twenty-five teachers and four full-time aides with a variety of technical skills
- A group of advanced users who fully integrate technology in their classrooms and fully meet Alberta Education's expectations of learner outcomes
- One to four computers per classroom and two labs
  - Project-based lab has Power Mac 5400/180s networked with Ethernet to LAN and hence to the entire division and the Internet through the T1 line that connects the town of Lacombe
- Created in 1996/1997 using computers leased for three years; will be upgraded in a year
- Keyboarding lab equipped with Mac Classics and SEs used primarily for word processing and spreadsheet work

School Vision of Technology Use/Integration

- School has philosophy and mission statement on use of technology
- Philosophy:
  - Provide opportunities for students to enhance their learning through technology.
  - Technology is not an end, but a tool that adds uniqueness and excitement to the learning process.
  - Students learn best when activities are meaningful, relevant and purposeful.
  - Students are given opportunities to incorporate various technologies into a learning experience.
  - Skills included are word processing, multimedia presentations, data management, information processing, inquiry and problem solving, and collaboration and communication.
- School committed to integrating technology outcomes as prescribed in Alberta Education's program of studies
- Mission statement: Inspire students to become responsible and efficient stewards of technology, which prepares them to be productive, effective contributors to the changing technological society.

- Goals of the program

  Students will:
  - have equal access to technology
  - use technology to augment their classroom learning
  - demonstrate proper use and care of the project-based lab

  Teachers will:
  - improve skill levels in the use of technology integration
  - collaboratively plan, prepare and implement projects that meet the general and specific outcomes of the program of studies

Length of Time School Has Focused on This Vision

- A number of years
- In 1995/1996, added technology co-ordinator (240 minutes per week in the first two years and now 400 minutes) and an additional co-ordinator (160 minutes per week)

What Technology Integration Looks Like in the School

- Expectation that all planning incorporates technology; teacher and co-ordinator plan and prepare collaboratively
- Teacher presents idea to one of two technology co-ordinators, indicating exactly what students are to do/achieve
- Teachers sign up to use project-based lab as needed and for the necessary time both for research and producing documents
- Adaptations made to meet the needs of individual teachers and classes
- Teacher teaches the content in a unit while the technology co-ordinator serves as an additional resource when needed
- Technology co-ordinators also conduct research and evaluate software which is purchased both to fill a need and to supplement resources

Staff Development

- Continue to use majority of professional development days on technology use
- Education plans reflect this growth
- Continue after school drop-in sessions to discuss needs and plan training accordingly
- In 1998/1999, technology co-ordinator will share a project for grade 5/6 use in the project-based lab at each staff meeting

Challenges Faced/Anticipated

- Sudden turnover of staff could negatively affect the present level of commitment, use and expertise
- Financial restraints may affect the position of a technology co-ordinator

Impact of Release of Learner Outcomes Document

- Two staff members were on team that created the outcomes for Alberta Education; therefore, outcomes not new to this school

Assessing Progress

- All project-based lab units include an evaluation component
- Teachers expected to have clear goals re what they hope to achieve with technology and evaluate whether they have achieved this
- Tracking number of times and length of time staff uses lab
- Technology co-ordinators contact staff members who seem not to be "on track," check re future plans and, if necessary, offer assistance
- Principal notified if there seems to be a problem (no problem so far)
- Technology co-ordinators model if necessary
- Integration and use of technology a priority
- Education plans consistently reflect growth in use of technology

LEO USAAK ELEMENTARY SCHOOL, RANKIN INLET, NORTHWEST TERRITORIES

Synopsis

The school and community share resources to improve community involvement in education, to preserve and promote Inuit culture, and bridge the generation gap. Information technology is the primary focus.

Contact: William Belsey

Description of School/Community

- Community-based institution in very remote community accessible only by air
- 360 students, 80 per cent Inuit
- Instruction in English and Inuktitut
- Full-time co-ordinator for information technology and the computer lab
- Programs for special needs students (one teacher and five assistants)
- Eight Inuit teachers (graduates of Nunavut Teacher Education program)
- School opened in 1988
- Traditional tribal society
- High unemployment rate (+23 per cent), but a recent boom
- Large business community, many businesses owned by Inuits
- Twenty Macintosh multimedia computers with CD-ROM drives and colour monitors on a high-speed Ethernet network which allows access to laser jet printer and sixty other computers in the school
- Two workstations with high quality 17-inch professional monitors, scanners, two ZIP drives and a digital camera
- Large collection of a variety of software

School/Community Vision of Technology Use/Integration

- Technology to preserve and promote Inuit culture and bridge the generation gap
- Expose students to critical information technology skills that are an integral part of employability skills
- Improve community involvement in education
- School is a tool to offer opportunities for economic development and community wellness
- Stimulate students' interest in lifelong learning and improve attendance
- Create a resource where all in the community have access to current information technology regardless of previous education, experiences or financial resources

Length of Time School/Community Has Focused on this Vision

- Work began in 1994 and grant received in 1995
- Sakku Investment Corporation provided money for updating hardware, etc.
- Other community partners provided additional support to maintain the operation
- Centre opened in November 1996

What Technology Integration Looks Like in the School (Community)

- School has information technology co-ordinator
- Operated with the assistance of thirty volunteers and open to anyone in the community during the evening and weekends
- All students in grade 3 to 6 have their own e-mail accounts and produce their own web pages
- K–6 students have regular classes in technology, working on such things as object-oriented programming, simple robotics and multimedia projects; access to Internet in every class
- Students volunteer in the centre; some work for wages

Staff Development

- Teachers have the opportunity to take a Certificate in Technology from McGill University

Results

- Students have access to state-of-the-art technology
- Can share and record information about Inuit culture and modern Arctic life with the rest of the world; in return they receive re-enforcement re the values of their culture
- Students' culture and language is automatically mirrored in the technology with Inuktitut syllabic font and syllabic keyboard overlays

Assessing Progress

- 3000 visits in less than a year with no reports of theft, vandalism or disturbances in lab or school
- 400 people (20 per cent of the population) with e-mail accounts
- Student attendance improved (+90 per cent) as has interest in learning and self-esteem
- Students asked to present at major conferences; program has received numerous awards and international attention from the media and educational organizations
- International model used by Industry Canada, CIDA and the 2B1 Foundation
- Presently creating a tool to more formally evaluate the program: a teacher checklist indicating that a skill has been Taught (T), Review is Needed (N), Understands Concept/s and Skill/s (U)
- Increased student pride in their culture due to positive feedback
- Students willing to volunteer, several are hired for positions based on their technology skills

MARY BUTTERWORTH SCHOOL
EDMONTON SCHOOL DISTRICT NO. 7

Synopsis

After six years of collegial sharing and planning for technology integration in a technology-rich environment with 115 computers in three areas, all students now receive computer instruction and assistance through a computer class and in conjunction with their other classroom activities. The teacher teams have designed major projects that integrate technology into core programming.

Contact: Wendy Mathieu

Description of School

- Six years old
- 552 students and twenty-three teachers in a demographically young neighbourhood with a high percentage of single-parent families in a lower to middle class socio-economic level
- 80 per cent of students have computers at home
- 115 workstations mainly in three areas—library, two computer rooms and workstations in a few classrooms; e.g. special needs.
- All computers have Internet access
- Eighty computers are LCIIs (1992 purchase) and thirty are new PowerMac 5500s
- Thirty teacher workstations with Internet access (variety of types, ages, etc.); three servers (two brand new) and seven laser printers; also digital camera, video camera and scanner
- Staff has technology "savvy," hired with focus on knowledge of technology
- Most students arrive with previous computer experience

School Vision of Technology Use/Integration

- To engage students in a variety of technology experiences
- Belief that technology is important in every student's education; must enhance the interaction and collaboration of student learning; and must be learned and then utilized in connection with all areas of student learning
- Technology must be readily available and working properly to allow students to be competent and competitive in today's world
- Technology knowledge is valueless unless it can be used in other aspects of a student's life

Length of Time School Has Focused on this Vision

- Six years

What Technology Integration Looks Like in the School

- Committee developed a scope and sequence for the school based on Alberta Education outcomes; then grade level teams met to develop integrated units of study for each grade level to meet the outcomes for that grade

- Students receive computer instruction, assistance and integration through computer classes and other classes
- Instruction from designated "technology" teachers familiar with technology and the curriculum at all levels for all subjects
- Teams of interested teachers integrated technology into core programming; e.g., grade 7
  Language Arts Link
  - Developing profiles (information access/introduction to document processing—e-mail, word processing)

  Social Studies Link
  - Culture magazine (document processing/information access—CD-ROM, Internet/web, desktop publishing)

  Health Link
  - MBS survival guide for grade 6 (programming—HyperStudio, multimedia projects, HTML web building)

  Science Link
  - Changes of earth's surface (document processing/information access—slide shows, web research skills)

  Math Link
  - Data management (document processing—database, spreadsheet)
- Two computer labs first available for computer teachers to teach their classes and then for other teachers to sign in for any free time
- Library lab has sign-in space available all the time for classes
- Students in technology classes learn the technology to meet the outcome requirements as they work on their core assignments

Staff Development

- Ongoing mini in-services from technology teachers who also keep school updated re availability of hardware and its uses; available throughout the year in mornings, lunch breaks, after school and during meetings
- Teachers can access the district's in-service programs
- Continuing use of staff, team and department meetings to promote staff development in the area of technology

Challenges Faced/Anticipated

- Need to continually upgrade as the skills and uses outpace the available technology
- 1998/1999 budget reflects the need for thirty new computers
- Development of assessment tools to evaluate process and product of students' work
- Establishing a tracking device to record learner outcomes may be necessary

Impact of Release of Learner Outcomes Document

- Firmed up and formalized the school program already being implemented
- Provided more leverage re integrating technology into the core program at all levels
- Helped to achieve the vision set out six years ago

Assessing Progress

- Staff interest on grade-level planning teams is high, with majority committed to integrated projects for next year

- Students continue to seek more time and more computers, excited and involved from 7:00 a.m. until sent home in the evening
- Annual district survey re how computers help in learning and completing work
- Rubrics scoring criteria being developed with integrated projects at each grade level
- Staff, students and parents have agreed to the need for technology expenditures

PENBROOKE MEADOWS SCHOOL
CALGARY SCHOOL DISTRICT NO. 19

Synopsis

This K–6 school serving a large high-needs population is integrating technology into the curriculum. Professional development, which is integral to the plan, is provided by an on-site technology co-ordinator who works directly with students and teachers and facilitates weekly staff development activities. Technical support is provided through partnerships. There is one lab, along with at least one computer in each classroom.

Contact: Gloria McBain, Technology Co-ordinator/Teacher Librarian

Description of School

- Lab with twenty-eight Macintosh computers; at least one Mac or PC in each classroom; one large-screen television linked to AV computer
- Educational partner provides technical support and access to a multimedia lab

School Vision of Technology Use/Integration

- Full integration into the curriculum
- Teaching and learning enhanced through effective use of educational technology

Length of Time School Has Focused on this Vision

- Six years (became a demonstration school in 1992)

What Technology Integration Looks Like in the School

- Co-ordinator works with all grades on a project or unit basis
- Each class has at least two forty-five minute periods in lab on six-day rotational basis
- Technology literacy taught within curricular framework
- Inquiry-based model

Staff Development

- Weekly in-service is the responsibility of a technology co-ordinator, who is a teacher leader on the TELUS Learning Connection Project
- Technology co-ordinator works directly with teachers and students in all curricular areas
- Technology co-ordinator/librarian and teachers plan jointly
- Specific technology workshops provided on request

Challenges Faced/Anticipated

- Financial concerns about keeping current
- Need for staff to respond to teachers' and administrators' need for assistance

Impact of Release of Learner Outcomes Document

- Provides guidelines and focus for teachers

Assessing Progress

- Based on student achievement in stated curricular outcomes

WESTGATE SCHOOL
CALGARY SCHOOL DISTRICT NO. 19

Synopsis

Four years of work with staff in this K–6 school have helped to identify and use technology as a flexible tool to support student learning. Integrated curriculum units requiring the use of technology have been developed. This school had developed a set of knowledge, skills and attitudes to support computer operations and awareness before Alberta Education released its learner outcomes document.

Contact: Daniel Therrien

Description of School

- 482 students, mainly French Immersion
- One computer lab in a semi-open space in the library
- School wired for telecommunications; is a leader in the use of technology as a tool to support student learning
- School has adopted another high needs school to create learning opportunities for both schools

School Vision of Technology Use/Integration

- Teachers develop new learning skills that use technology as a flexible tool to transform the schooling of children
- Teachers progress through five levels: entry, adoption, adaptation, appropriation, invention

Length of Time School Has Focused on This Vision

- Four years

What Technology Integration Looks Like in the School

- Technology used as a tool to support learning of the program of studies
- Integration includes:

  Language Arts
  - e-mail to get information and vocabulary for stories, letters, etc.
  - Wiggleworks to enhance reading and writing for younger students

  Social Studies
  - Internet and ClarisWorks to build a community (grade 2)
  - interactive information on ancient Greece (grade 6)

  Math
  - ClarisWorks and HyperStudio (drawing, creating templates for games)
  - spreadsheets and word processing for fractions, decimals, probabilities, number recognition, geometry, patterns, numeration, graphics

Science
- databases for making graphs, etc.
- drawing, painting, scanner, spreadsheets

Art
- Internet to visit a museum

- Large blocks of time, using reservation system in computer lab
- Balance between time-specific projects and ongoing computer-assisted work
- Librarian support for teachers in planning and overseeing children
- Para-professional computer and technician expert
- Parents help with committee work and support children in the computer lab

Staff Development

- Professional development days, after-school workshops, twice-a-month breakfast clubs, conferences such as ATAAC
- Examining a variety of uses of technology
- Practising and learning software programs such as ClarisWorks and HyperStudio

Challenges Faced/Anticipated

- Financial support for hardware, software, cabling and people training
- Time for staff to practise
- Required technical support and expertise (on site)
- Parent education
- Children learning faster than the availability of people and material resources can support

Impact of Release of Learner Outcomes Document

- Already in harmony with Alberta Education's outcomes

Assessing Progress

- Success in progressing through the five levels; degree to which using of technology is as natural as paper, pencils, books and blackboards
- Balance among instructional models to ensure the integration of technology with the program of studies
- Realization of school-defined computer operations and awareness

WESTMINSTER SCHOOL
LETHBRIDGE SCHOOL DISTRICT NO. 51
GRADE 5/6 CLASSROOM

Synopsis

A teacher uses one computer with Internet access to achieve the goals of her technology plan. With these limited resources, she uses peer tutors and has students work in groups of two or three at the computer station to complete teacher-assigned tasks appropriate to different subject areas. An old Apple IIe lab is available and used for keyboarding and curriculum support.

Contact: Patricia Boehm

Description of School

- One computer per classroom with Internet access
- Lab with old Apples used mainly for keyboarding and programs for math skills, reading and word processing

What Technology Integration Looks Like in this Classroom

- One half-hour period scheduled for journal writing or silent reading while small groups of two or three students access computer
- Students taught to save on floppy disk under own name
- Teacher demonstrates program to small group, who work on the assignments and then become peer tutors
- A group also may use an available computer in another classroom
- Usually requires about two weeks for all students to complete an assignment
- Examples of assignments: word processing; creating a table to use as a weekly planner for assignments; spreadsheets and Chart Wizard in Excel for graphing and math units; web pages to enhance language arts, social studies and science curriculum

Staff Development

- Teacher took an HTML coding course which enables relatively safe Internet use on links that she has designed

Challenges Faced/Anticipated

- Most students were computer illiterate (only two of twenty-five students had computers at home)
- Finding an effective way to use the computer in the classroom that fits into the curriculum and does not interrupt flow of teaching
- Supervising class while helping students at computer

Assessing Progress

- Initial scepticism about one computer in a classroom proved unfounded
- Students go beyond what is required and demonstrate no fear of technology